

Mathematics of finance

Time Value of money

What is interest ?

→ ~~3th~~ ~~part~~

જો 100 રૂા ધરવામાં 2 વર્ષ માં
જો 100 રૂા ધરવામાં 2 વર્ષ માં
20 રૂા ધરવામાં 2 વર્ષ માં

I = Rate of Interest → 2%

P = Principal → 1000

$$I = P \times n \times r$$

$$I = 1000 \times 5 \times 0.10$$

$$= 500$$

$$A/FV = P + I$$

$$= 1000 + 500$$

$$= 1500$$

Contents

1. Interests

2. Simple Interest

3. Compound Interest

4. Nominal and effective

5. Continuous compound
(બારમાસી)

6. Depreciation

7. Discounting

8. Annuity

9. Derivation of different
type of annuity

10. Amortization

sinking Funds

11. Business Application

amount to retirement

Q2,

$$FV = PV(e^{in}) \rightarrow 500 \text{ million over 50 years}$$

$$= 10000(e^{.10 \times 50})$$

$$= 10000 \times e^{5.0}$$

$$\text{amount} = 2648.72$$

H.W

Ex-6)

$$FV_{OA} = PMT \left\{ \frac{(1+n)^n - 1}{n} \right\}$$

$$= 1.00 \left\{ \frac{(1+.10)^5 - 1}{.10} \right\}$$

$$= 1.00 \times \frac{.62051}{.10}$$

$$= 6.1051$$

$$PMT = 1.00$$

$$R = 10\%$$

$$= 0.799 = I$$

$$n = 5$$

Ex - 7

We know

$$FVAD = PMT \left\{ \frac{(1+r)^n - 1}{r} \right\} (1+r)^n$$

$$= 1.00 \left\{ \frac{(1+0.10)^5 - 1}{0.10} \right\} (1+0.10)$$

$$= 1.00 \left\{ \frac{0.61051 - 1}{0.10} \right\} (1+0.10)$$

$$= 1.00 \times 6.71561$$

$$= 6.71561$$

Part - B

Problem - B1

$$A. FVIF = (1+r)^n$$

$$= (1+0.12)^2$$

$$= 1.2544$$

$$r = 12\%$$

$$= 0.12$$

$$n = 2$$

~~Problem B2~~

$$\begin{aligned} B. FVIF &= (1+r)^n \\ &= (1.06)^3 \\ &= 1.1910 \end{aligned}$$

$$\begin{aligned} r &= 6\% \\ &= 0.06 \\ n &= 3 \end{aligned}$$

$$\begin{aligned} C. FVIF &= (1+r)^n \\ &= (1.09)^2 \\ &= 1.1881 \end{aligned}$$

$$\begin{aligned} r &= 9\% \\ &= 0.09 \\ n &= 2 \end{aligned}$$

$$\begin{aligned} D. FVIF &= (1+r)^n \\ &= (1.03)^4 \end{aligned}$$

$$\begin{aligned} r &= 3\% \\ &= 0.03 \end{aligned}$$

$$= 1.12(35+1) \quad n = 47.1$$

Problem - B2

Compounded yearly

$$\begin{aligned} FV &= PV(1+r)^n \\ &= 12000(1+0.12)^5 \\ &= 12000 \times 1.7623 \end{aligned}$$

Time Value of money

present value of money

$$FV = PV(1+r)^n$$

PV

$$PV(1+r)^n$$

$$= FV$$

$$PV = \frac{FV}{(1+r)^n}$$

$$of = N$$

$$of = n$$

$$P = N$$

$$PV = 30,320$$

$$\left(\frac{1}{1+r} \right)^n = \frac{PV}{FV}$$

Exm:- 2)

$$PV = \frac{10000}{(1+.10)^{10}}$$

$$= \frac{10000}{2.5937}$$

$$= 3855.49$$

$$PV = \frac{FV}{(1+r)^n}$$

$$PV = \frac{10,000}{(1.10)^{10}}$$

$$PV = 3855.49$$

Topic 2: 200 H.W

Example 8, 9, 10, 11

$$\frac{FV}{(1+r)^n}$$

required compounding to arrive at

$$FV = 2,10,000$$

$$n = 10$$

$$r = 20$$

$$m = 4$$

$$FV = PV \left(1 + \frac{r}{m} \right)^{n \times m}$$

$$PV = \frac{FV}{\left(1 + \frac{r}{m} \right)^{n \times m}}$$

→ PV value, where r is rate

$$PV = \frac{FV}{\left(1 + \frac{r}{m} \right)^{n \times m}}$$

$$PV = \frac{2,10,000}{\left(1 + \frac{20}{4} \right)^{10 \times 4}}$$

$$= 37,24$$

Ans: 37,24 is compounding 20

$$FV = PV (e^{in})$$

$$PV = \frac{FV}{e^{in}}$$

$$2 \text{ ~~Ans~~ } \leftarrow \frac{10,000}{e^{.10 \times 10}}$$

H.W.

Ex-08

We know,

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{10000}{(1+0.10)^5}$$

$$= 6209.21$$

Ex-09

Half yearly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.05)^{20}}$$

$$= 613.91$$

$$FV = 10,000$$

$$R = 10\%$$

$$= 10$$

$$n = 5$$

$$FV = 1000$$

$$R = \frac{10\%}{2}$$

$$= 5\%$$

$$= 0.05$$

$$n = 20 \times 2$$

$$= 40$$

Quarterly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.25)^{20}}$$

$$= 610.27$$

$$r = \frac{10\%}{4}$$

$$= 0.025$$

$$n = 5 \times 4$$

$$= 20$$

Bimonthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.1667)^{30}}$$

$$= 608.98$$

$$r = \frac{10\%}{6}$$

$$= 0.01667$$

$$n = 5 \times 6$$

$$= 30$$

Monthly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.0833)^{60}}$$

$$= 607.79$$

$$r = \frac{10\%}{12}$$

$$= 0.00833$$

$$n = 5 \times 12$$

$$= 60$$

Weekly discounting

$$PV = \frac{FV}{(1+r)^n}$$

$$= \frac{1000}{(1+0.001923)^{260}}$$

$$= 606.83$$

$$F_x - 20$$

$$FV = PV (e^{im})$$

$$= 50,000 (e^{0.20 \times 25})$$

$$= 224084.1535$$

$$F_x - 27$$

We know,

$$PV = FV (e^{-in})$$

$$= 10000 (e^{-2.0 \times 5})$$

$$F_2 = 6065.30$$

$$n = \frac{10\%}{52}$$

$$= 0.001923$$

$$n = 5 \times 52$$

$$= 260$$

$$PV = 50,000$$

$$i = 10\%$$

$$= 0.20$$

$$n = 25$$

$$FV = 20,000$$

$$i = 10\%$$

$$= 0.20$$

$$n = 5$$

Mathematics of Finance

(Time Value of Money)

What is Interest?

Ex - 2000

2000

Principal (2000)

$I = P \times n \times r \rightarrow$ Rate of Interest
Amount of Interest
number of years

$$I = 2000 \times 5 \times 0.10$$

$$= 1000$$

$$A/FV = P + I$$

$$= 2000 + 1000$$

$$= 3000$$

Contents

1. Interests
2. Simple Interests
3. Compound Interests
4. Nominal and effective rates of Interest.
5. Continuous Compounding (various problems)
6. Discounting
7. Depreciation
8. Annuity
9. Derivation of Different type of Annuity
10. Amortization
11. Sinking Funds
12. Business Applications

Value starts same ✓ Compound Interest.

1000	10%	①	1000
1100	10%	②	1100
1210	10%	③	1221
1331	10%	④	133.10
1464.10	10%	⑤	16146.41
			<u>610.51</u>

$P = 1000 \rightarrow$ ~~Not to be~~ Days 20 Review

$n = 5$

$I = 10\% \rightarrow 0.10$ 10% max $\rightarrow 1000 \times 0.10 = 100$ $\rightarrow 1000 + 100 = 1100$ *

$m = 360$

$FV = ?$

$$= 1000 \left(1 + \frac{0.10}{360} \right)$$

$$= 1000 \left(1 + \frac{0.00278}{1} \right)$$

$$= 1648.61$$

34,

$$FV = PV(e^{in})$$

→ 34

$$= 1000 (e^{.10 \times 5})$$

$$= 1000 \times e^{.50}$$

$$= 1648.72$$

Business of Communication

Math matters of Finance

→ Annuity $\Rightarrow$ Ordinary annuity

(ii) ~~As~~ Annual annuity

Annuity - $\frac{PMT}{r}$ | $\frac{PMT}{r}$ $\frac{1}{1+r}$

Ans: Annuity is $\rightarrow$ regular payment.

⇒ An annuity due is a series of payments made at the beginning of each period.

income tax benefits are,

Ex: 3 non. few

$F \cdot V_A$ work done by force A through distance V_A

$FV \rightarrow 750, 1000$
 $\bullet A$ 2 PMT
 A $\left\{ \frac{(1+r)^n - 1}{r} \right\}$ $1000000 = 1$

$$FV_{AD} = \textcircled{M}_T^A \left\{ \frac{(1+n)^n - 1}{n} \right\} (1+n)$$

~~DAW~~

G. 7.

page 2-7

QNT-2)

$$\therefore I = \text{Amount of simple}$$

$$\therefore I = 10,000 \times 0.10 \times 10$$

$$= 10,000$$

where,

A = Amount of at the end year

P = Principal amount

I = Amount of simple interest.

Here,

$$A = ?$$

$$P = 10,000$$

$$I = 10,000$$

$$A = P + I$$

$$= 10,000 + 10,000$$

$$= 20,000 \text{ (Ans)}$$

Here,

$$I = 10,000$$

$$P = 20,000$$

$$i = 10\%$$

$$= 0.10$$

$$n = 10 \text{ year}$$

QNT - 2)

We know,

$$A = P(1 + in)$$

Where,

A = Amount of the sum

P = Amount of Principal

i = Rate of interest

n = Number of years

Here, $A = 7,500$

$$P = 2$$

$$i = 10\%$$

$$i = 0.10$$

$$n = 5 \text{ years}$$

$$n = 5 \text{ years}$$

$$\text{So, } 7,500 = P(1 + 0.10 \times 5)$$

$$\text{Or, } 7,500 = P(1.50)$$

$$\text{Or, } 7,500 = P(1.50)$$

$$\text{Or, } P = \frac{7,500}{1.50} = 5,000 \text{ Tk}$$

Ex-6)

We know,

$$A = P(1 + in)$$

Where, A = Amount in Future

P = Amount of principal

i = rate of simple interest

n = number of years

$$\text{So, } 17,000 = 10,000(1 + 10i)$$

$$\text{or, } \frac{17,000}{10,000} = 1 + 10i$$

$$\text{or, } 1.7 = 1 + 10i$$

$$\text{or, } 1.7 - 1 = 10i$$

$$\text{or, } 0.7 = 10i$$

$$\text{or, } i = \frac{0.7}{10} = 0.07$$

$$\text{So, } i = 7\%$$

Hence,

$$A = 17,000$$

$$P = 10,000$$

$$n = 10 \text{ years}$$

$$i = 7\%$$